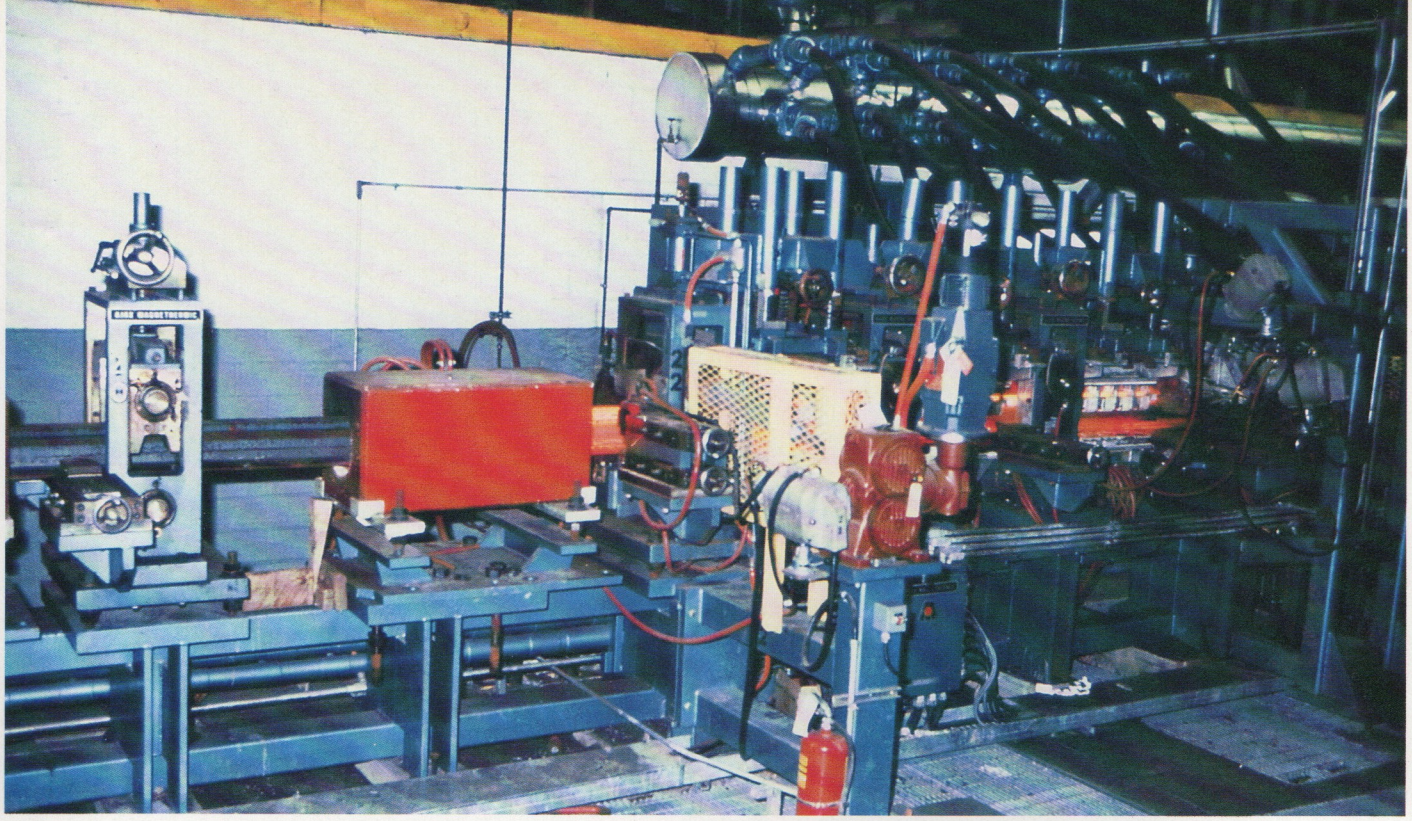
FULL HEAD HARDENED
RAIL
FOR THOSE
EXTRA CRITICAL
APPLICATIONS
SYDNEY STEEL CORPORATION



# FULL HEAD HARDENED RAIL

IN 1990, SYDNEY STEEL CORPORATION COMMISSIONED A NEW OFF-LINE HEAD HARDENING FACILITY AND BEGAN SUPPLYING PREMIUM ALLOYED HEAD HARDENED RAIL TO IT'S HEAVY HAUL CANADIAN CUSTOMERS. THIS FULLY HEAT TREATED RAIL OFFERS THE FOLLOWING ADVANTAGES:

- ULTRA CLEAN STEEL
- LADLE METALLURGY
- VACUUM DEGASSING
- BLOOM CONCAST
- UNIVERSAL ROLLING
- CUSTOMIZED PROFILES
- DEEP HARDNESS PATTERN
- NO RE-STRAIGHTENING
- LOW RESIDUAL STRESS
- FULL PEARLITE STRUCTURE
- SUPERIOR TOUGHNESS
- HIGH WELDABILITY

## CHEMICAL PROPERTIES

| C | Mn | Si | Cr | P | S |
|---|---|---|---|---|---|
| .76/.82 | .80/.95 | .65/.80 | .45/.55 | .030 Max. | .020 Max. |

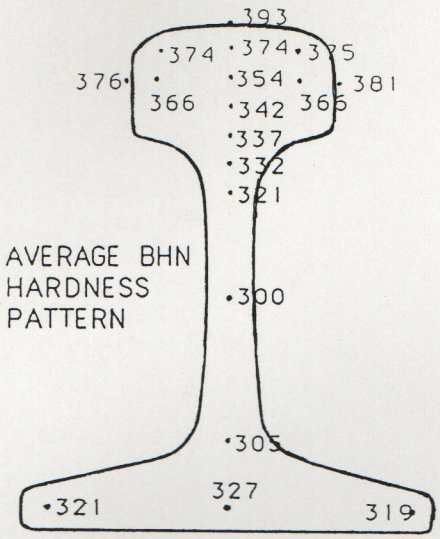
## MECHANICAL PROPERTIES

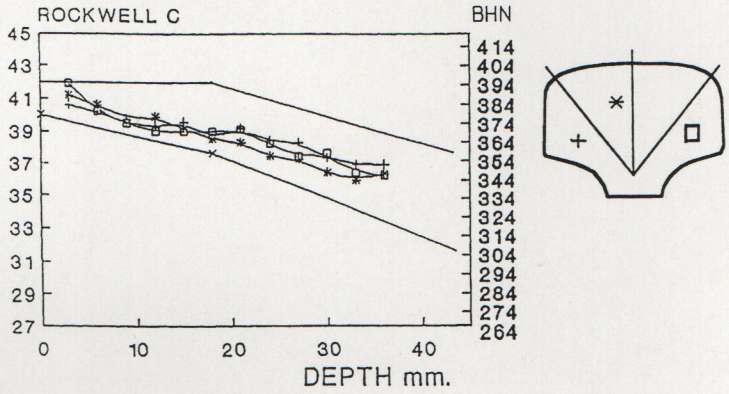
| 0.25 PS KSI (MPa) | T.S. KSI (MPa) | ELONGATION % | R/A % |
|---|---|---|---|
| 127 (860) | 190 (1310) | 13.8 | 38 |

COVER PHOTO: COURTESY OF CN

# HARDNESS PATTERN

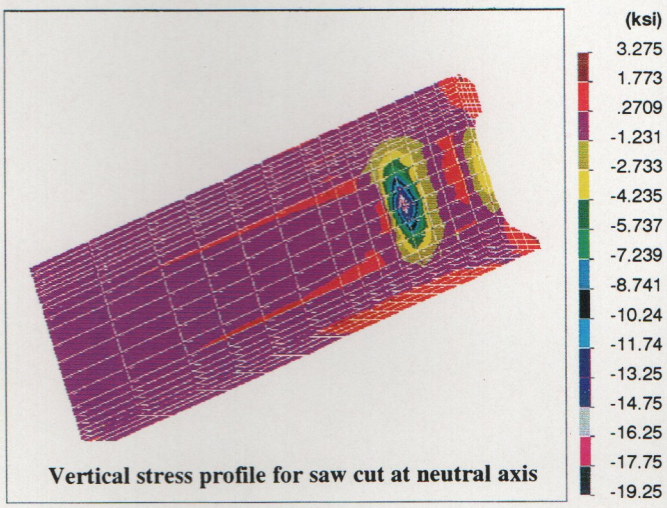
THE FULL SECTION AVERAGE BRINELL HARDNESS PATTERN AND ROCKWELL **C** HEAD TRANSVERSE PATTERN ARE SHOWN BELOW. ALL TESTS ARE CARRIED OUR AS PER **ASTM** STANDARD.



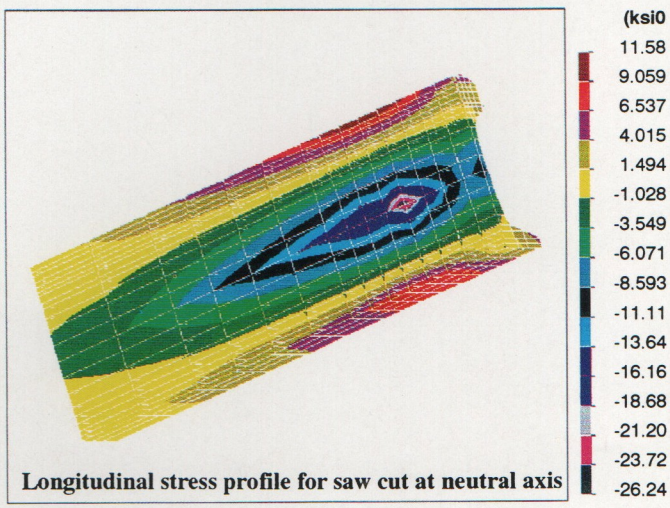




# RESIDUAL STRESS

SYDNEY STEEL'S FULLY COMPUTERIZED HEAD HARDENING PROCESS HEATS THE COMPLETE RAIL SECTION TO A UNIFORM AUSTENITE GRAIN SIZE AND THEN UTILIZES A CONTROLLED AIR QUENCH TO DEVELOP A FINE HIGH WEAR PEARLITE STRUCTURE DEEP IN THE RAIL HEAD AND HIGH TOUGHNESS PROPERTIES IN THE RAIL WEB AND BASE. OVERALL RAIL STRAIGHTNESS IS TIGHTLY CONTROLLED IN THE PROCESS AND NO ADDITIONAL ROLLER STRAIGHTENING AFTER THE HEATING AND QUENCHING CYCLE IS REQUIRED. FINITE ELEMENT ANALYSIS (CHARTS BELOW) SHOW THE BENEFICIAL EFFECT OF COMPRESSIVE RESIDUAL STRESS ALONG THE VERTICAL AXIS OF THE WEB.




**Vertical stress profile for saw cut at neutral axis**




**Longitudinal stress profile for saw cut at neutral axis**

RESIDUAL STRESS CHARTS: COURTESY OF ARRT

**SYDNEY STEEL CORPORATION**
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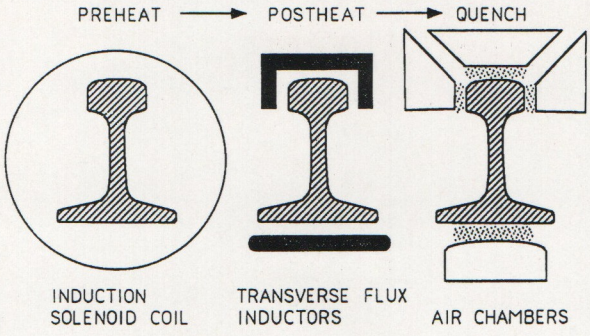
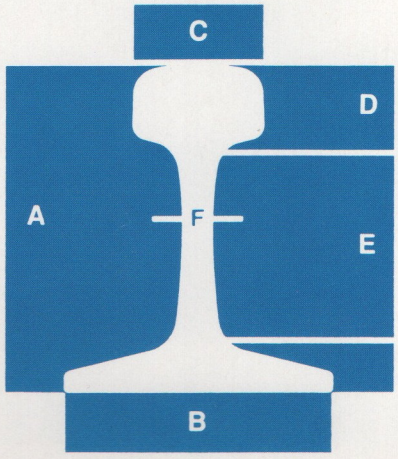
TELEX: 019-35197




# SPECIFICATIONS

SYDNEY STEEL MANUFACTURES FULL HEAD HARDENED RAIL TO MEET DOMESTIC AND INTERNATIONAL SPECIFICATIONS INCLUDING CNR, CPR, BCR, QCM AND AREA. RAILS ARE PRODUCED IN THE SECTIONS SHOWN BELOW AND IN LENGTHS UP TO 25 METERS.

## NORTH AMERICAN RAIL SECTIONS

| SECTION | WEIGHT K.G. METER (APPROX.) | A MM | B MM | C MM | D MM | E MM | F MM | CALCULATED WEIGHT LBS./YARD |
|---|---|---|---|---|---|---|---|---|
| 136-14 RAD. | 67.55 | 185.7 | 152.4 | 74.6 | 49.2 | 106.4 | 17.5 | 136.2 |
| 136-10 RAD. | 67.68 | 185.7 | 152.4 | 74.6 | 49.2 | 106.4 | 17.5 | 136.43 |
| 136- 8 RAD. | 67.69 | 185.7 | 152.4 | 74.6 | 49.2 | 106.4 | 17.5 | 136.45 |
| 136- 4 RAD. | 67.70 | 186.5 | 152.4 | 74.6 | 49.2 | 106.4 | 17.5 | 136.48 |
| 132 R.E. | 65.52 | 181.0 | 152.4 | 76.2 | 44.5 | 106.4 | 16.7 | 132.1 |
| 115 R.E. | 56.89 | 168.3 | 139.7 | 69.0 | 42.9 | 96.8 | 15.9 | 114.7 |
| 100 A.R.A.-A. | 49.8 | 152.4 | 139.7 | 69.9 | 39.7 | 85.7 | 14.3 | 100.4 |
| 100 CP-RE | 50.8 | 154.0 | 136.5 | 68.3 | 43.7 | 83.3 | 14.3 | 102.4 |

## INTERNATIONAL RAIL SECTIONS

| SECTION | WEIGHT K.G. METER (APPROX.) | A MM | B MM | C MM | D MM | E MM | F MM | CALCULATED MM LBS./YARD |
|---|---|---|---|---|---|---|---|---|
| UIC 60 | 60.34 | 172.0 | 150.0 | 74.3 | 51.0 | 89.5 | 16.5 | 121.64 |
| UIC54 | 54.43 | 159.0 | 140.0 | 72.2 | 49.4 | 79.4 | 16.0 | 109.73 |
| GB50 | 51.51 | 152.0 | 132.0 | 70.0 | 42.0 | 83.0 | 15.5 | 103.85 |